Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

whether a given course is in itself equal to another, as with the more important question whether it is best fitted to develop those phases of mind for which it is established.

Charles DeGarmo

Swarthmore College

THE WASTE OF MATHEMATICS

There was a time, not many decades ago, when the culture of the colleges and the curricula of the schools consisted of Latin, Greek, and mathematics, in quantities varying with the thoroughness of the institution, but with quite a constant interdependent ratio. The heads of each of these departments watched one another most jealously to see that no one attempted to exceed his proper share of the student's time. While they were thus engaged in tripartite defence, other foes, foes from without, assumed the quiet aggressive and little by little the sciences found a place in the college course of study.

Latin was not at all averse to this inroad, because the nomenclature of science is largely taken from that tongue. Greek looked with forbearance upon the innovation for a like reason and shuddered only when hybrid words were called into use. Mathematics regarded the intrusion of the sciences with especial joy; they gave a strong reason for the extension of mathematical studies, and soon formed with them an inseparable alliance.

The time of the student, once divided by three, now came to have four for its divisor and as the sciences became differentiated a still further division became necessary. If the time was originally fully occupied what would be the effect of this increase of claimants? Either the ability to acquire information must be increased in like proportion or the demands of each subject must submit to a decrease. In one, at least, of the original three the converse of the second alternative has been observed. Mathematics has asserted that first of all it, as the great disciplinary study, cannot be subjected to curtailment and secondly, as the framework of proof in all the exact sciences, it must grow as they grow.

Let us examine this claim of mathematics. Is it the only disciplinary study? When its only rivals were Latin and Greek, and they were regarded as food for memory, unquestionably it offered the only as well as the best training for the reasoning faculties. It alone could conduct an investigation or demonstration from accepted truths to ultimate conclusions; it could start with axioms visibly true in the concrete and pass to conceptions that exist only in the abstract, and it formed the type of deductive processes. In character it has not changed, it still possesses its pristine merits, but the methods of teaching and the habits of study are so changed that other subjects fall into a similar if not same category.

Man intellectually is a biped, his two mental powers of locomotion are induction and deduction, and for his secure advance the one is just as important as the other. While resting upon one of these supports, giving it the increasing strength that comes from exercise, he is better prepared to reach forth the other and secure for it a safe resting place and then it receives the vigor of action. Whatever there may be of weakness in this sinister member—induction, is compensated for in cunning and falls short of being dextral only by being deficient in latent strength.

If the inductive processes are of equal value with those known as deductive, then those subjects which rest on the former are as important from the standpoint of discipline as mathematics can claim to be. These processes in the modern methods of instructing form the essential parts in science, language, and even in history, political economy, and psychology, therefore they are worthy of attention as aids in mental development. But while they are taking on day by day more and more of the disciplinary character, mathematics, which once claimed the sole power to develop mental growth, holds on to its original one-third of the student's time. The logical conclusion to which this leads us is that the amount of mathematics taught must be curtailed, if the demands of the sciences upon it can then be met.

Do we need the amount of mathematics now included in our undergraduate courses? Of course no reference is made here to the advisability or necessity of every one devoting three or four years to this subject; but in passing it might be said that when we remember that the great Cayley began life as a barrister and

that one of America's greatest mathematicians was for many years a teacher of music, it is neither safe nor wise to say that because my life work is to be thus or so I shall not study this or that subject. When we regard the course of the college student as preparatory we must advise a wide range of study, even if we sacrifice the *multum* for the *multa*.

But, to go back to our theme, do we need for subsequent study or general culture the *multa* of mathematics or the *multum*? Have we too many topics or too much of each? The number of topics is practically fixed by a consensus of opinion, but the amount of matter crowded within the backs of our text-books has been increased steadily to forestall possible criticism or to include subjects that rivals had omitted, until now we have algebras and geometries of five hundred pages and two volumed treatises on calculus as books for college students. Usually the teacher omits parts and the students not wishing to be outdone in generosity omit other parts. To the author this seems strange, but it is true that the student, not knowing the relative importance of the various topics, regards an omission as arbitrary and sees no reason why the next difficult chapter or paragraph should not be left out. The same is true when portions are in fine print, only in this case the decision was made by the author. This growth in the size of text-books in mathematics is unwarranted and without a parallel in subjects that are unvarying so far as the elements are concerned. It surely is time for reaction, for a curtailment. How can it be done so as not to interfere with its utilitarian side?

The method is simple and practical even if liable to the objection that no two persons would wholly agree as to the means of executing it. My plan would be to go through the applied sciences and note every principle of mathematics referred to either directly or indirectly; would then demonstrate each of these principles fully and with all possible extensions and generalizations, and all principles to which these demonstrations refer or on which they depend. Follow this plan until axioms are reached, classify the results topically and we should have all that we need of algebra, geometry, analytical geometry, trigonometry, and calculus. A series of text-books prepared on this plan with references ahead as well as back would contain about half as much as those now in use, they would be direct, with everything given for

a purpose, which is, in itself, an incentive and would leave no room for dangerous exclusions of parts. If the former theses were sustained showing that mathematics is not the only disciplinary study and that a mind can be developed with the aid of other subjects, then this abbreviated course of mathematics would prove ample for its share of discipline, and leave more time for those other topics which alike possess the dual merit—mental stimulus and practical ends.

It must be remembered that this course is intended for general students and is not supposed to form the be all and end all for specialists. They will seek an extension of their knowledge in those larger treatises to which they would eventually turn even if they waded through the padded books now in use.

In addition it is confidently believed that such a direct treatment would be equally valuable with the more elaborate treatises in arousing a deeper interest in mathematics and in developing exceptional geniuses.

Much attention has been lately given to the question how to teach mathematics; of more importance is the query how much mathematics should we teach.

J. Howard Gore, Professor of Mathematics
Columbian University

THE STUDY OF IRVING

The majority of children who knock at our high school doors, are the friends of American poets. Through the winsome lines of "Hiawatha" and "Snow-Bound," they have gained a love for Longfellow and Whittier, but classic prose is a sealed book. A few, who were trained in Froebel ways, have made acquaintance with Washington Irving through their study of old Dutch life in Manhattan. They have studied pen pictures from the "Knickerbocker," and have sketched and colored the quaint homes. As literature was revealed through the study of early history and geography, the children were delighted with the story of the little New York boy who prowled among the narrow streets, peered into the